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The lake *in your* community

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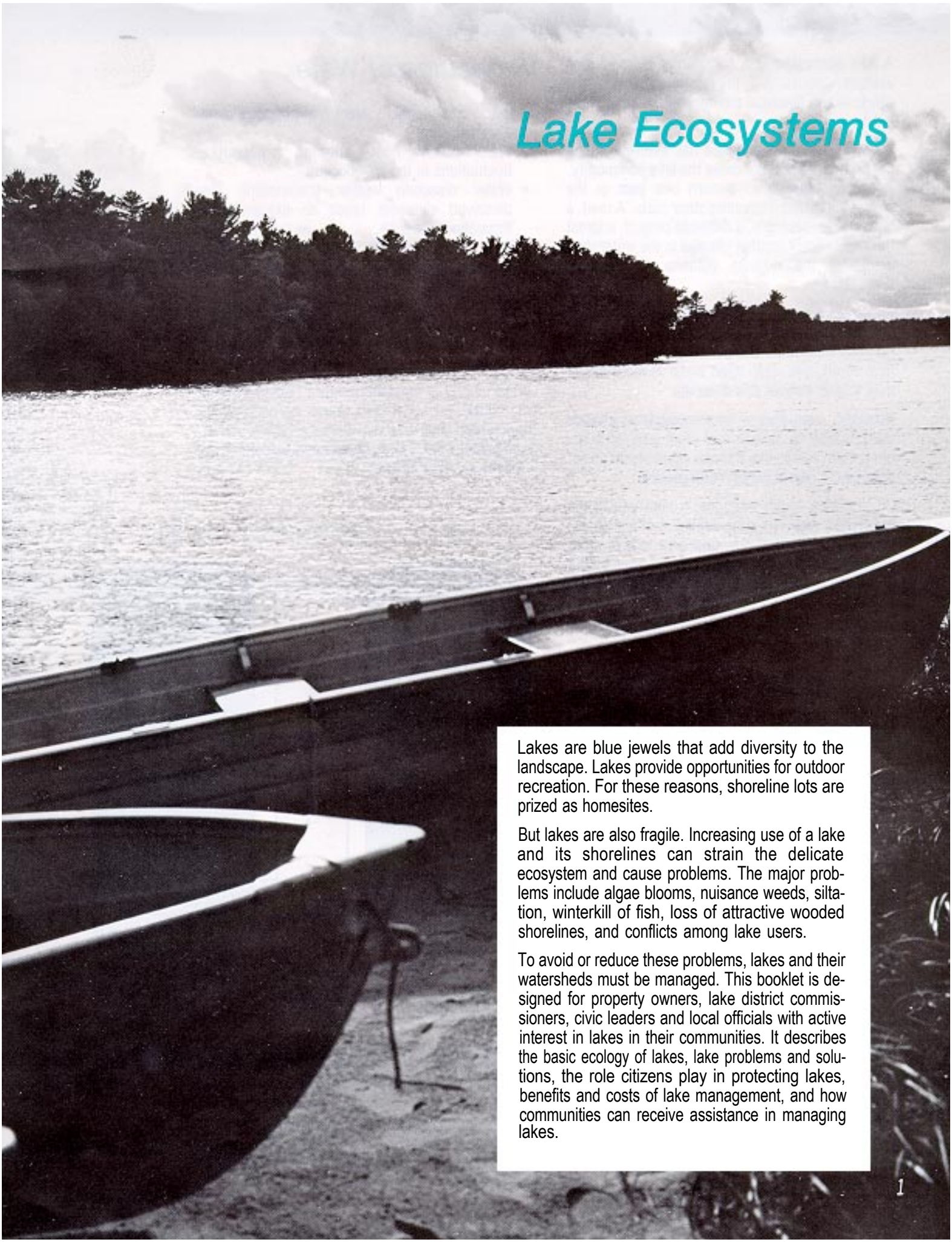
Lake Ecosystems



Lakes are blue jewels that add diversity to the landscape. Lakes provide opportunities for outdoor recreation. For these reasons, shoreline lots are prized as homesites.

But lakes are also fragile. Increasing use of a lake and its shorelines can strain the delicate ecosystem and cause problems. The major problems include algae blooms, nuisance weeds, siltation, winterkill of fish, loss of attractive wooded shorelines, and conflicts among lake users.

To avoid or reduce these problems, lakes and their watersheds must be managed. This booklet is designed for property owners, lake district commissioners, civic leaders and local officials with active interest in lakes in their communities. It describes the basic ecology of lakes, lake problems and solutions, the role citizens play in protecting lakes, benefits and costs of lake management, and how communities can receive assistance in managing lakes.

A lake ecosystem is a community of interacting animals, plants and microorganisms and the physical and chemical environment in which they live.

A complex interdependence has evolved among the organisms that comprise the lake community. It is not possible to disturb one part of the ecosystem without affecting other parts. A road, a housing development, a drainage project, a forest fire, acid rain or another change in the watershed can alter the delicate balance of the lake ecosystem.

An ecosystem with a great diversity of life forms and habitats is stable. A lake that has extensive marshes around it, shallow areas near shore (littoral zone), and deep open water is more stable than a lake without this diversity.

However, even diverse lake ecosystems change from season to season and from year to year. Short-term events like a single algae bloom do not necessarily signal a long-term problem.

On the other hand, changes in land use in the watershed may not immediately manifest themselves in the lake. It may take a decade or more before the effects of new agricultural practices or urbanization result in weed problems or fish kills.

Origin of Lakes

Even without human disturbances, lakes are temporary features of the landscape. They can be expected to disappear in several thousand years as their outlets enlarge through erosion, or as they fill through sedimentation.

Most Wisconsin lakes were formed by glaciers. Ice blocks buried within glacial deposits melted to form steep-sided kettle lakes. Other lakes were formed when glacial debris dammed up valleys.

Wisconsin also has a number of bog lakes, particularly in the northern part of the state. Usually landlocked, these are mostly kettle lakes, with little outlet flow and minimal fluctuation of water levels. Characteristically, their brown water is acidic and floating mats of vegetation extend out from their shores.

Oxbow lakes are created when a river cuts across a meander, isolating the old river bed and forming a generally horseshoe-shaped lake.

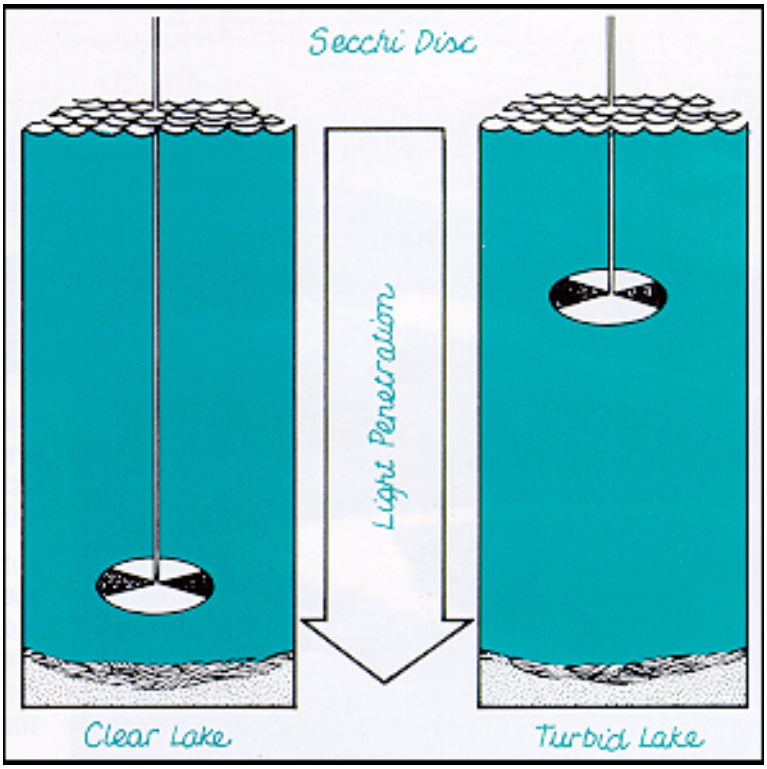
Lakes are also formed behind dams created for hydropower, flood control, recreation, or irrigation. Many communities were built around millponds that supplied power to saw logs or grind grain.

Properties of Water

Water is an essential solvent that supports plant and animal life.

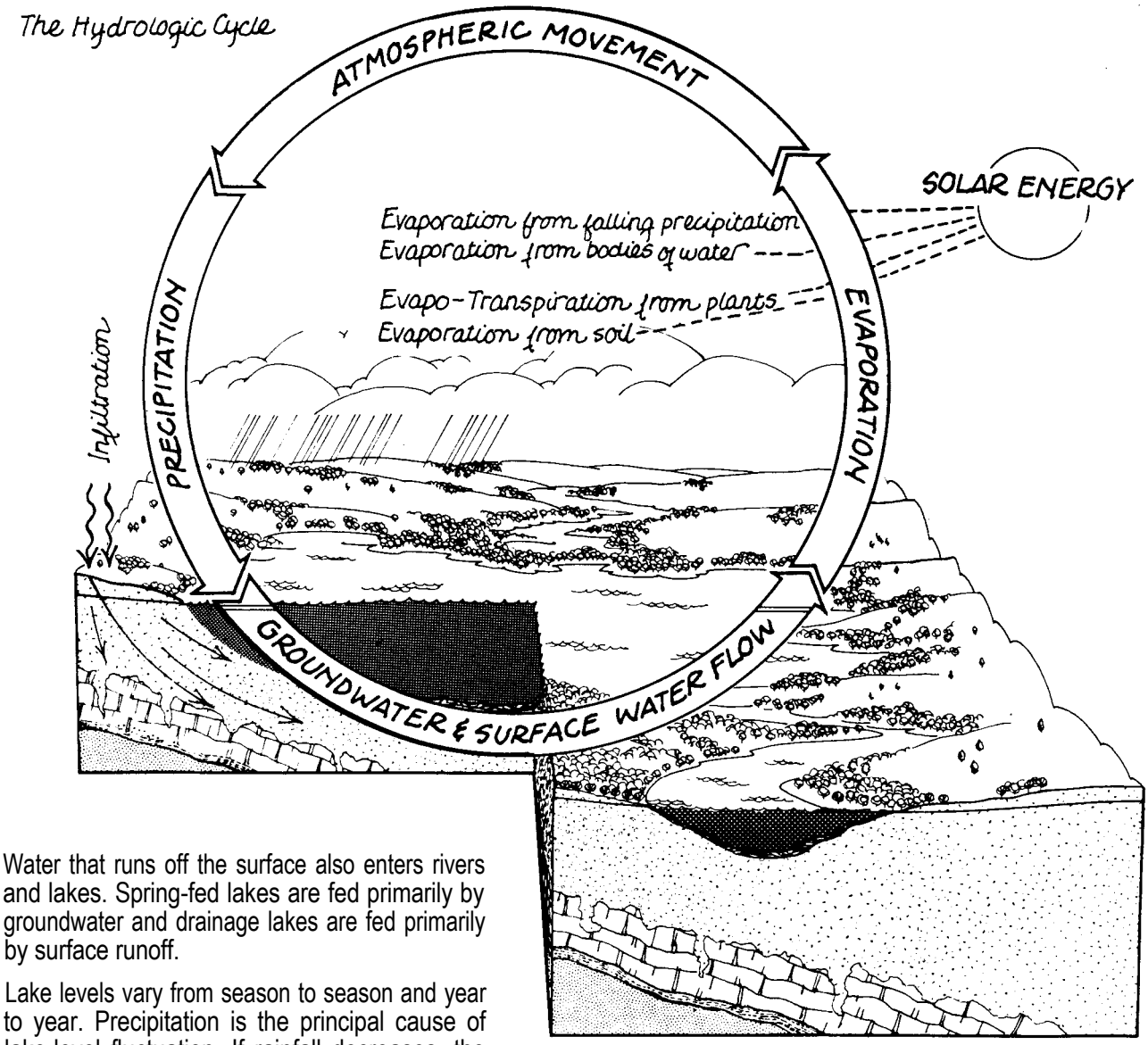
- Water retains heat—buffering temperature fluctuations in the air above it.
- Water dissolves matter—transporting the dissolved elements (such as oxygen gas) throughout the lake.
- Water is less dense in its solid state—allowing lakes to freeze from the top, protecting the water below.
- Water holds substances in suspension where they can participate in ecosystem interactions.
- Water is transparent—allowing the sunlight to penetrate to more than 10 feet in clear lakes.

Water clarity is measured with a Secchi disc. If the white and black disc cannot be seen when submerged only a short distance, the water is said to be turbid. Lake turbidity may be caused by siltation or algae blooms.



Movement of Water

In Wisconsin, about three-fourths of the precipitation that falls reenters the atmosphere by transpiration from plants and evaporation from the earth's surface. In flat or sandy areas, most of the remaining water enters the groundwater and moves underground toward lakes and rivers. Many lakes are intersections of water table and land surface.



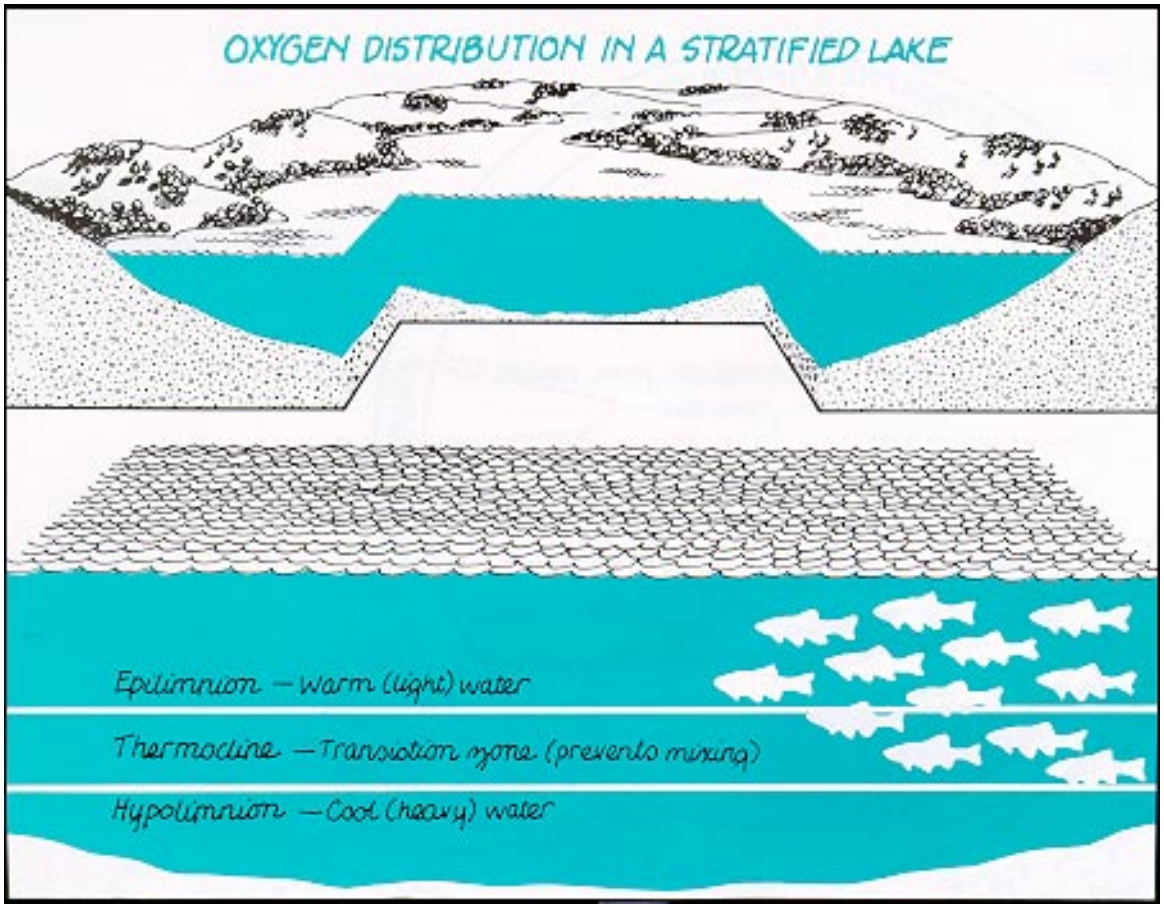
Water that runs off the surface also enters rivers and lakes. Spring-fed lakes are fed primarily by groundwater and drainage lakes are fed primarily by surface runoff.

Lake levels vary from season to season and year to year. Precipitation is the principal cause of lake-level fluctuation. If rainfall decreases, the lake levels fall. If rainfall increases, lake levels eventually rise. However, the lag between precipitation and lake-level change varies from days to years depending on the lake. Dams can be used to modify some of these fluctuations, but varying lake levels are a normal characteristic of the natural system.

Lake Oxygen Supplies

Oxygen gas is a common substance dissolved in lake water. It is absorbed from the atmosphere and is produced by aquatic plants. However, in winter the oxygen in the atmosphere is sealed off from the lake by ice, and a snow blanket on the ice may prevent sunlight from reaching the plants. Without light, the plants die. Then instead of the plants producing oxygen, their decomposition consumes oxygen. The combination of these two factors often causes winterkill in shallow lakes which are not replenished by inflowing water. The stored oxygen in the water is depleted by late winter. Such lakes can be aerated artificially, the snow can be removed from the ice, or steps can be taken earlier to reduce or harvest weed growth.

During the summer, water in a shallow lake is kept thoroughly mixed by the wind, unless the lake is small and protected from the wind. Water in deep lakes stratifies into thermal layers. Cool water is heavy and stays in the lake bottom in a layer called the hypolimnion. The warm water stays on top in the epilimnion. A narrow band of transition from cold to warm water is called the thermocline. During summer months, little mixing occurs between layers.



Water in the epilimnion is in contact with the air, and has plenty of oxygen. However, if plant matter or sewage is decaying on the lake bottom, the oxygen in the hypolimnion may be depleted. Fish that require cool water with high oxygen levels can no longer survive.

During the spring and fall the temperature between the layers of water disappear. These "turnover" periods allow the entire lake to be reoxygenated and fish may inhabit the deeper waters.

The demand for oxygen caused by the decay of sewage, algae or vegetation is called the biochemical oxygen demand (BOD). As the amount of decaying matter in the lake bottom increases from more sewage or excessive plant growth in the lake, dissolved oxygen (DO) levels fall and certain desirable sport fish disappear.

The Food Web

The food web begins with green plants. With the help of sunlight and chlorophyll (as a catalyst), plants convert carbon dioxide and water into sugar and oxygen gas. Reactions that take place during this process—called photosynthesis—are complex.

The sugar produced during photosynthesis is glucose. From it green plants synthesize other sugars, starches, fats, and cellulose—the ingredients of living matter. The food web transfers these ingredients and energy from organism to organism. Plants are eaten by animals and animals are eaten by each other. The predator of one species is prey of another.

The oxygen produced during photosynthesis is vital to animals for breathing. Oxygen is also needed by bacteria and fungi that decay plant and animal matter. Decomposition is a needed phase in the cycle of life. Through decomposition, nutrients are recycled for continued plant growth.

More than one species is involved in each step of the cycle of growth and decay.

With all essential conditions and materials present, a particular plant or animal population will grow and multiply until one of the materials becomes scarce or limiting.

Among plants, the controlling factor is usually phosphorus—a plant nutrient. The available phosphorus may be used by microscopic plants (algae). Addition of more phosphorus from sewage treatment plants, urban and farmland runoff and septic tanks is likely to increase the intensity of algae blooms and unbalance the food web.

Rooted plants are a normal and essential part of a healthy ecosystem. They are limited by

phosphorus and the depth to which the sunlight can penetrate the water. If more phosphorus is added, or if sedimentation makes the lake shallower, these plants can spread and become a nuisance to recreation and to the winter survival of the fish when the rotting plants use oxygen.

Habitats

Organisms require habitats that provide food, shelter, reproduction sites, oxygen, proper temperature and other conditions. A water lily needs soft sediments to allow its large tuberous root to grow, and its needs shelter from strong winds. Its flexible stems can withstand only moderate wave action and changes in water level.

Fish also occupy a unique ecological niche within the larger habitat. For example, a walleye has special eyes to catch small fish at night when its prey cannot see as well as it does. Walleye can survive in large lakes with few weeds and in turbid lakes with algal blooms. However, they need gravel bars for spawning and may swim far upstream to find appropriate spawning grounds.

Northern pike and muskie need wetlands to spawn in and weeds to hide in. They ambush their prey during daylight, using their long bodies to strike from behind rocks, logs and weeds.

Bluegills, bass and crappie spawn along the shores of lakes without migrating to new habitats. They clean the silt from the bottom by fanning, lay their eggs, fertilize the eggs, and fan them to keep them supplied with oxygen. In large lakes, however, big waves can destroy the spawning beds of these species. These fish need weeds for cover; their bodies are designed to turn quickly to escape predators.

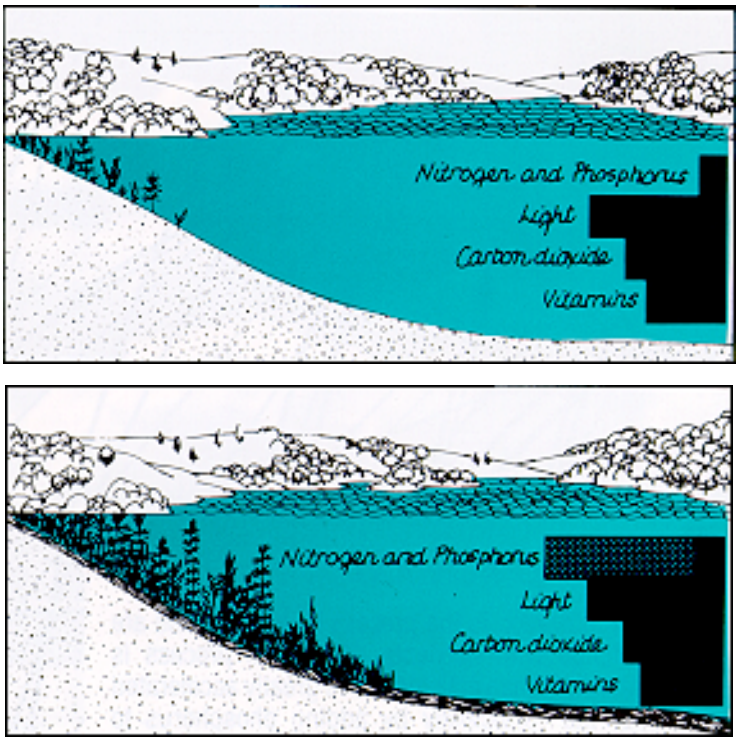
Because of the needs of each species for a special habitat, fish stocking has limited potential. Fish such as walleye cannot reproduce in most small lakes. Where natural reproduction occurs, stocking usually will be insignificant, compared to the numbers of fry born naturally. Existing fish can also decimate new stockings of fry.

Protecting the natural habitat maintains a balanced ecosystem and desirable species of both fish and plants.

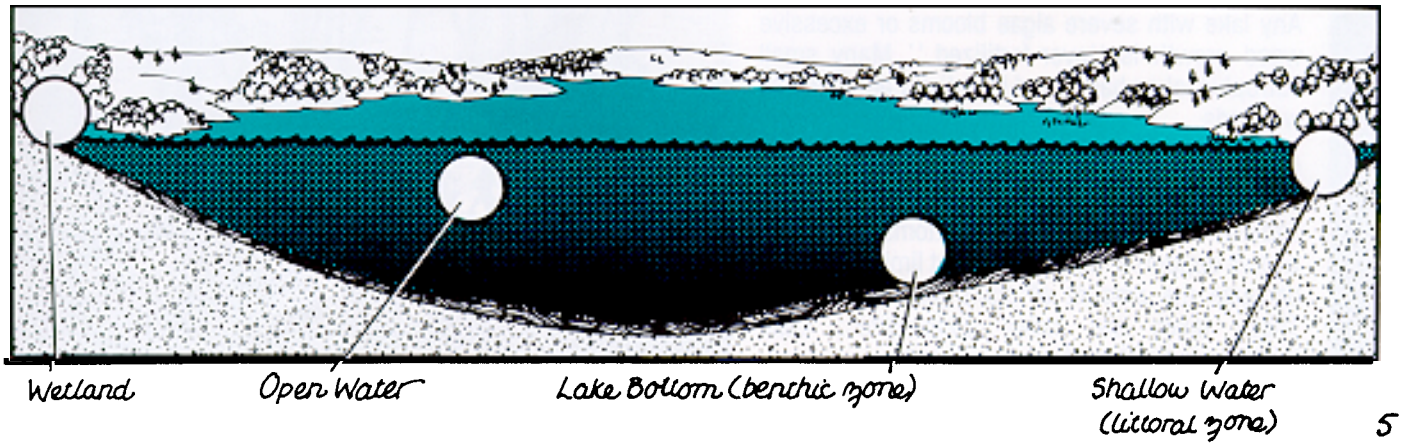
While various species live mainly in a particular habitat, they belong to a larger interacting community. Because of these relationships, the best way to manage the numbers and types of plants and animals in a lake is to deal with the entire community rather than to attempt to manage an individual plant or animal species.

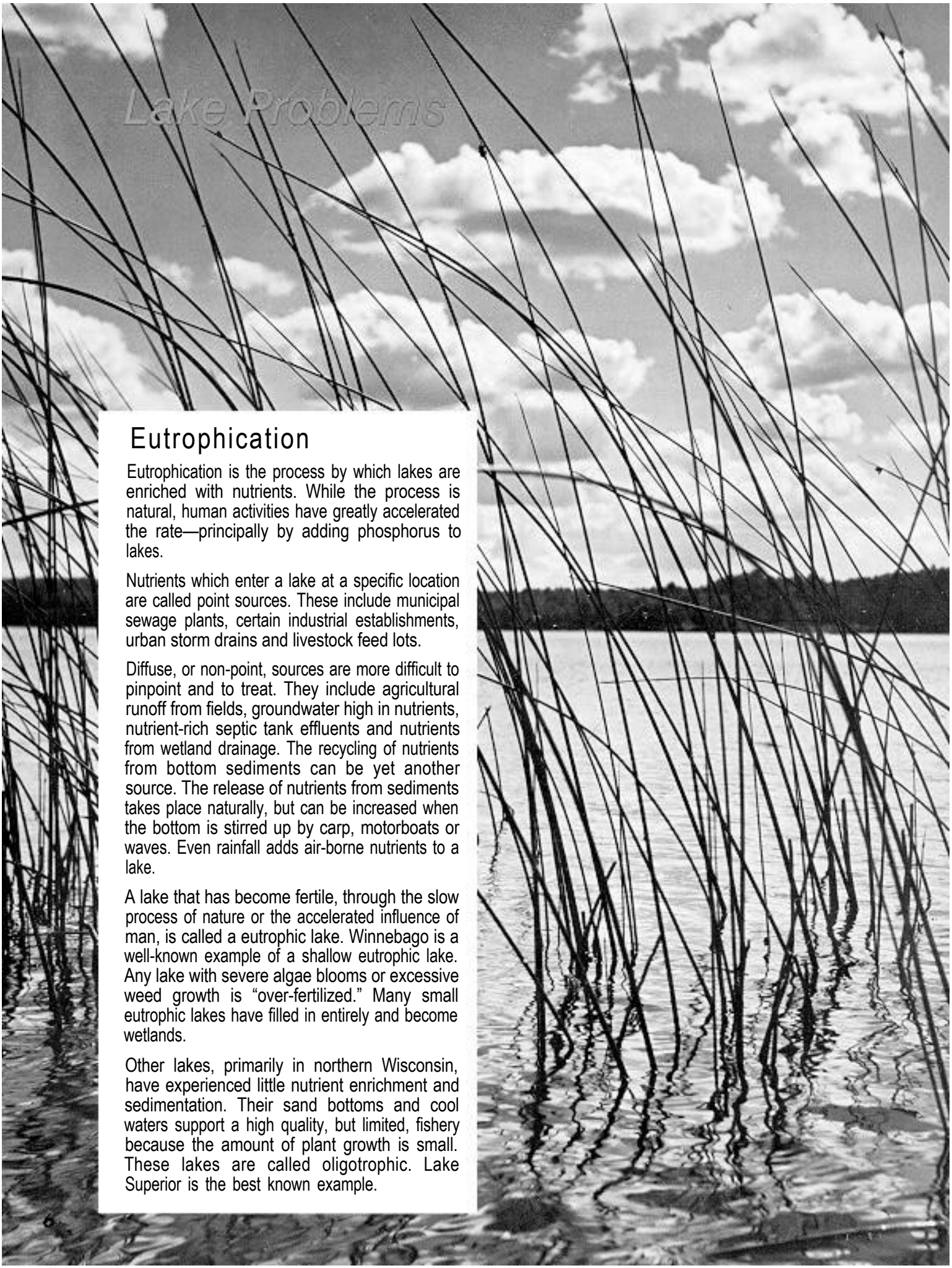
If one habitat is altered, the whole community is changed in some way.

LIMITING FACTORS



REPRESENTATIVE HABITATS IN A LAKE





Eutrophication

Eutrophication is the process by which lakes are enriched with nutrients. While the process is natural, human activities have greatly accelerated the rate—principally by adding phosphorus to lakes.

Nutrients which enter a lake at a specific location are called point sources. These include municipal sewage plants, certain industrial establishments, urban storm drains and livestock feed lots.

Diffuse, or non-point, sources are more difficult to pinpoint and to treat. They include agricultural runoff from fields, groundwater high in nutrients, nutrient-rich septic tank effluents and nutrients from wetland drainage. The recycling of nutrients from bottom sediments can be yet another source. The release of nutrients from sediments takes place naturally, but can be increased when the bottom is stirred up by carp, motorboats or waves. Even rainfall adds air-borne nutrients to a lake.

A lake that has become fertile, through the slow process of nature or the accelerated influence of man, is called a eutrophic lake. Winnebago is a well-known example of a shallow eutrophic lake. Any lake with severe algae blooms or excessive weed growth is “over-fertilized.” Many small eutrophic lakes have filled in entirely and become wetlands.

Other lakes, primarily in northern Wisconsin, have experienced little nutrient enrichment and sedimentation. Their sand bottoms and cool waters support a high quality, but limited, fishery because the amount of plant growth is small. These lakes are called oligotrophic. Lake Superior is the best known example.

Sedimentation

Closely associated with nutrient enrichment is sedimentation. As wind and water move soils from uplands down to a lake, the lake becomes shallow. This is a natural aging process governed by gravity and the force of rain and wind.

However, sedimentation is greatly accelerated by activities that leave the soil bare for extended periods, that take place on steep slopes, and that occur in close proximity to a lake or inlet streams.

In reservoirs formed behind dams, sedimentation is rapid. Streams normally carry a suspended load of fine particles. When stream water enters a reservoir, water speed is reduced and these materials settle out.

Sedimentation is also caused internally as plants die and decay on the lake bottom. Such organic sediments are commonly called muck, which may be many feet thick.

Contamination

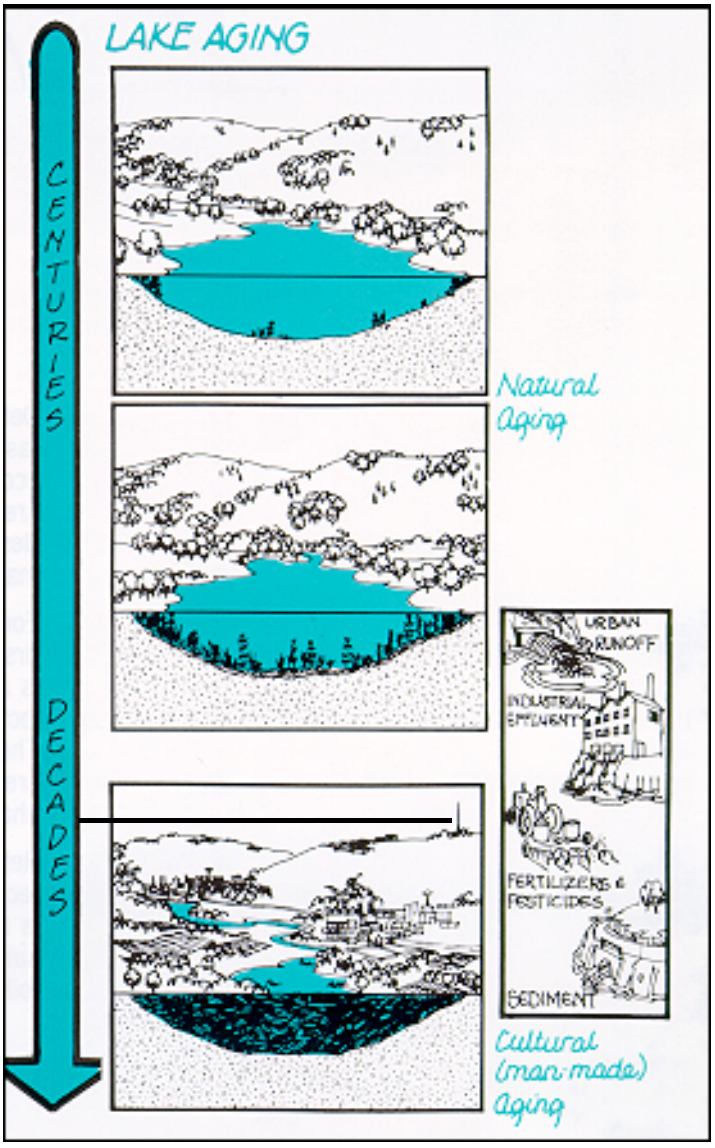
Contamination is caused by the addition of harmful materials to a lake. These materials may be chemicals, such as herbicides, pesticides, arsenic or mercury, and a variety of industrial waste products. The materials may be organisms that cause disease in people or damage plants or animals in the lake. The presence of intestinal bacteria results in the closing of public swimming areas and frequently threatens the drinking water of lake property owners.

While certain chemicals have useful management purposes, contaminants in general disrupt the natural balance. Chemical treatment of weeds may result in algae blooms as nutrients are released from decaying plants. Carp and exotic crayfish can also control lake weeds, but typically damage the fishery at the same time.

Acid Rain

Acid rain is formed when air pollutants–primarily sulfur and nitrogen oxides–are emitted by coal-fired power plants, cars, natural processes and industries. These oxides combine with water in the atmosphere to form sulfuric and nitric acids, which fall to earth with rain or snow and eventually alter the chemical balance of the environment.

The concentration of hydrogen ions (pH) determines the acidity of the water. The higher the concentration, the lower the pH and the greater the acidity. Precipitation in Wisconsin is about 4.6 on the pH scale.

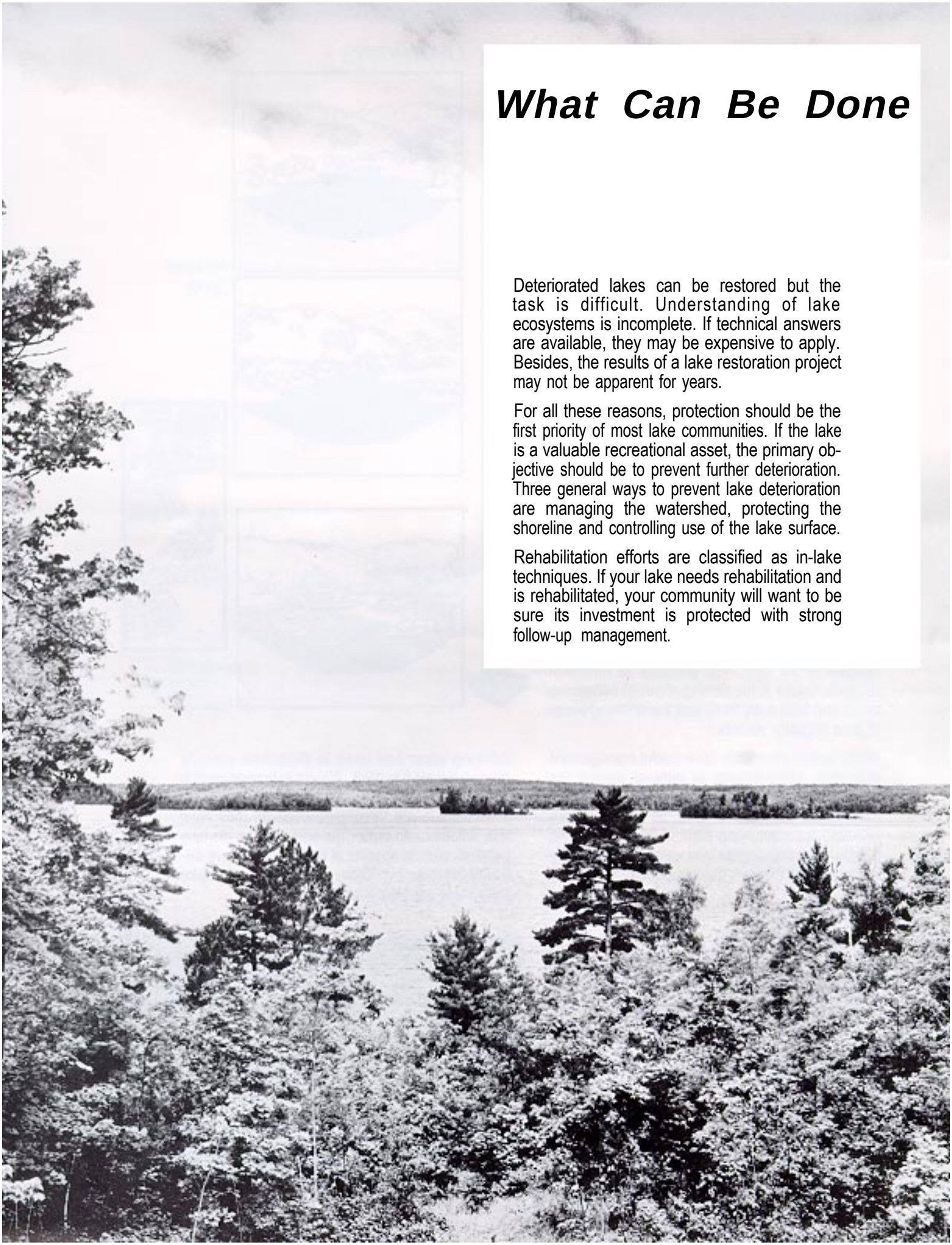


Drinking water and lakes in Wisconsin typically range from pH 6 to pH 8. Waters in limestone-rich areas have highest pH. Lakes in the northern part of Wisconsin are threatened because they have little limestone to buffer the acid. As the pH falls below 6, certain species of fish begin to have difficulty reproducing. Other organisms in the lake ecosystem are also affected.

ACIDITY LEVELS AT WHICH SPAWINING IS INHIBITED

Water ph	Fish Species	Comparable Acidity
7.0		(Distilled water)
6.0	Walleye	Pea juice
5.5	Lake trout Smallmouth bass	Spinach juice
5.0	Northern pike Sunfish Bullhead	Carrot juice
4.5	Perch	Beer

What Can Be Done



Deteriorated lakes can be restored but the task is difficult. Understanding of lake ecosystems is incomplete. If technical answers are available, they may be expensive to apply. Besides, the results of a lake restoration project may not be apparent for years.

For all these reasons, protection should be the first priority of most lake communities. If the lake is a valuable recreational asset, the primary objective should be to prevent further deterioration. Three general ways to prevent lake deterioration are managing the watershed, protecting the shoreline and controlling use of the lake surface.

Rehabilitation efforts are classified as in-lake techniques. If your lake needs rehabilitation and is rehabilitated, your community will want to be sure its investment is protected with strong follow-up management.

Watershed Management

A watershed is the area of land from which water drains into a given lake or river. A lake is a product of its initial size and depth and its watershed. The speed with which a lake fills in and becomes enriched depends on the movement of soil and nutrients from the watershed to the lake.

All activities on the land, especially home building, road construction, logging and farming, have the potential to increase erosion and damage lakes. However, with proper precautions, the soil erosion from these essential economic activities can be minimized.

Professional advice on reducing erosion can be obtained, without charge, from these offices in county courthouses: County Land Conservation, University of Wisconsin-Extension, and U.S. Soil Conservation Service.

Here are some corrective actions which tend to reduce the transport of nutrients and soil into lakes:

The county code administrator is the official with principal responsibility for enforcing shoreland zoning, which covers all land within 1000 feet of a lake or 300 feet of a stream.

FARMING

- Minimum tillage
- Contour farming
- Clean water diversion around barnyard
- Storing manure in winter
- Increasing forage acreage (less corn)
- Efficient use of fertilizer
- Fencing streambanks
- Ordinances to limit soil loss

URBAN AREAS

- Ordinances to control erosion from construction sites
- Holding areas for runoff from big parking lots
- Sweeping leaves and dirt from streets
- Cleaning storm sewer catch basins
- Diverting storm sewers or sewage effluent

HIGHWAY AND UTILITY CORRIDORS

- Proper route selection
- Sedimentation traps
- Mulching and seeding
- Spillways and waterways
- Diversions

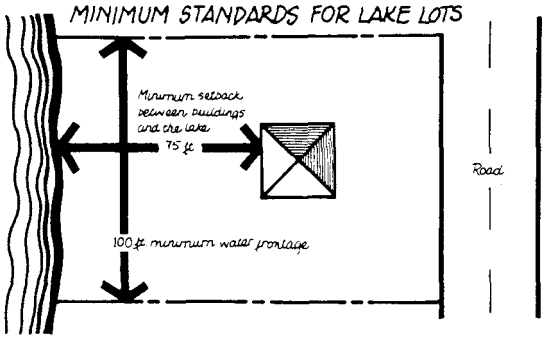
FORESTRY

- Leaving timber on very steep slopes
- Logging steep slopes and low areas when ground is frozen
- Building stream and gully crossings
- Reforestation
- Excluding livestock

Shoreline Protection

Note: The following characterizations of lake property owners are based on a formal survey conducted by the Wisconsin Survey Research Lab.

Wisconsin law requires counties to adopt and enforce shoreland protection ordinances. Lake property owners support regulations which are as restrictive as the present state standards shown below:

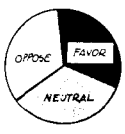


A clear majority also favor controlling building design and color and prohibiting filling or dredging on the shoreline.

In general, lake property owners recognize and advocate the need for controls on land subdivisions, commercial development and construction activity. These attitudes demonstrate their willingness to support public officials in their efforts to protect shorelands from overuse.

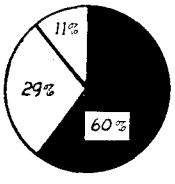
While lake property owners oppose high density development on the shoreline and support controls designed to protect shorelines from new development, many of them continue to disturb their own shoreline. Educational efforts and suggestions from neighbors could reduce this problem. A natural shoreline buffer of vegetation is important to intercept soil and nutrients headed for the lake. It also provides habitat for fish, frogs and other wildlife. Perhaps most important, the vegetation protects the natural beauty of the lake.

Some communities have purchased critical shorelines and wetlands to protect them from development.



Key

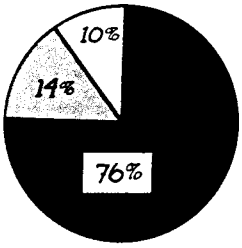
Minimum distance between any building and the lake



Restrictions on the external appearance of buildings

Prohibition of filling or dredging on the shoreline

Boating Controls



Control of motorized recreation i.e.; limiting size of outboard motors, restricting times and areas for water skiing and motor boating, confining snow mobiles to marked trails and muffling of motors.

Lake property owners believe there is a need for greater community control over motorized recreation. Even though the families of most lake property owners engage in boating and almost half water ski, about three out of four lake property owners favor control of these activities. They also want snowmobile and trail bike use regulated.

Since property owners will be directly affected by regulation of motorized recreation, they should take part in determining relevant local town board or city council policies.

It may not always be possible to make motorized recreation compatible with canoeing, sailing, hiking and nature study. Local government can adopt ordinances to separate the activities in different areas or at different times. Lake property owners recognize that control of motorized recreation is needed to protect the quality of other forms of outdoor recreation and to preserve the solitude and beauty that they cherish.

In-Lake Techniques

Dredging is a water quality improvement technique that removes nutrient-rich sediments. It has broader purposes too. Dredging can increase the usable amount of lake surface for recreation and navigation. It increases depth and volume of oxygenated water to help sustain fish life. And it deepens the littoral (near shore) zone to retard plant growth by increasing depth below the photic zone of light penetration. Little sunlight is available below 10 feet of water.

There are also difficulties with dredging. It may be hard to find places to dispose of the dredged material. If the material is dumped in adjacent wetlands, the lake's natural buffer zone is harmed. Dredging disrupts lake habitats. Where large aquatic plants have been removed, the nutrients they once used may now be available for algae growth. The algae problem may be harder to treat than the original weed problem.

Perhaps most important, dredging can be prohibitively expensive. Costs vary up from $1.50 per cubic yard, depending on site conditions. Dredging 10 feet of sediment from a 16 acre lake can cost a quarter million dollars or more.

Since 1982, dredging has been considered a low priority for state cost sharing.

Nutrient inactivation is another possible way to limit lake fertility by treating (inactivating) nutrients with chemicals. Alum has been added to lakes to settle out phosphates. This method was first tested in the United States in May 1970 in eastern Wisconsin. Alum is now used in several states. Short-term results of the alum treatment are encouraging: less lake nutrients, less algae growth, improved oxygen conditions and no apparent ecological harm. But alum treatment is still in the experimental stage.

Harvesting rough fish (netting carp) removes nutrients, reduces turbidity, and improves spawning conditions for game fish, but may also permit aquatic vegetation to flourish.

Mechanically harvesting weeds keeps surface water open for navigation and recreation. It also improves the appearance of the lake. If cut weeds are removed from the lake, the rate of organic sedimentation is reduced.

However, in eutrophic lakes, only relatively small amounts of nutrients are removed by mechanical harvesting and it is primarily a cosmetic improvement, like mowing a lawn. Some communities have been harvesting for years.

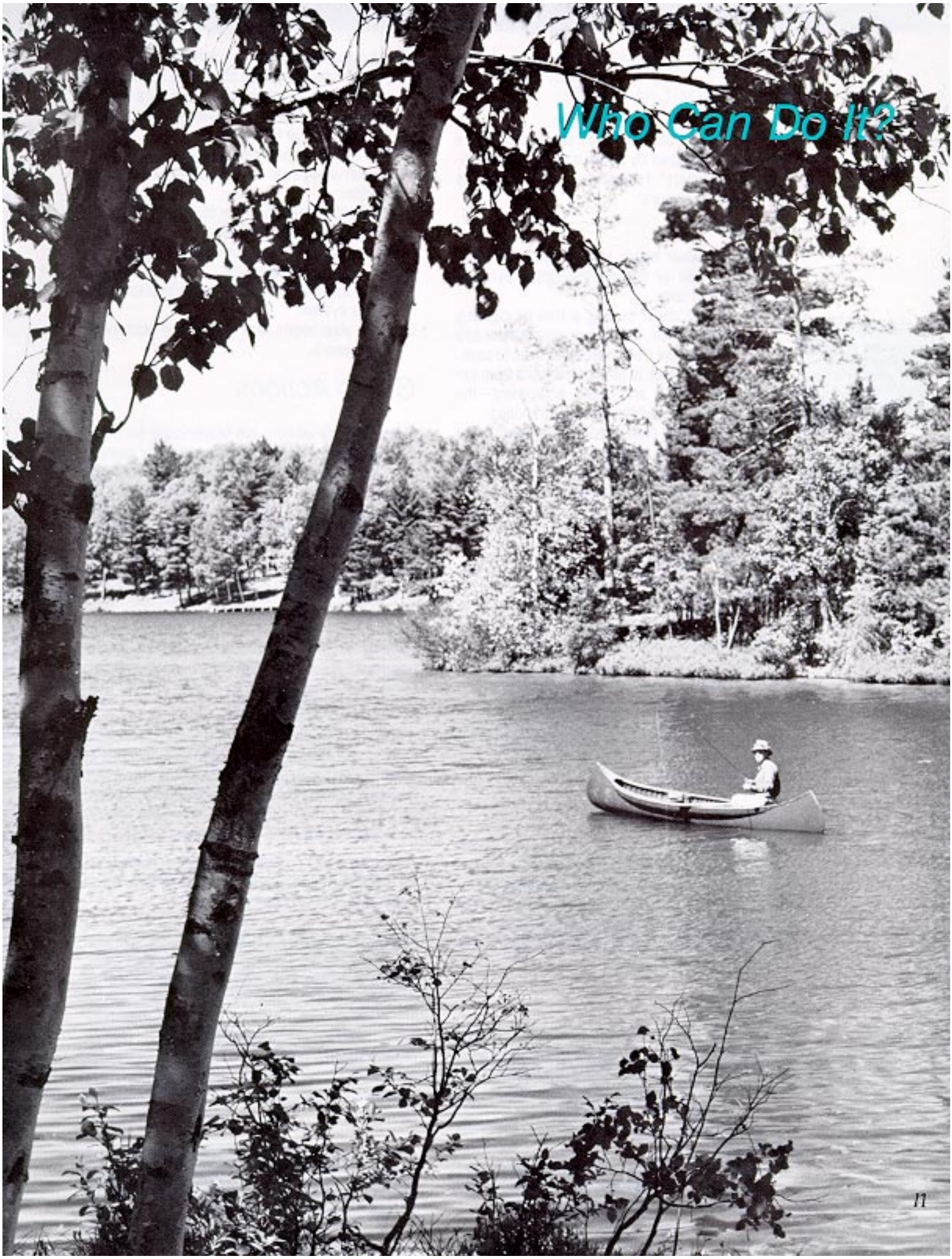
Chemical Control Harvesting algae from lakes is largely experimental. Chemical treatments are the only means to control severe nuisances that interfere with recreation. The treatment does not remove nutrients from the lake, and repeated treatments may be necessary in the same season. Additionally, there is concern about the unknown effects of these chemicals in lakes.

Aeration Oxygen depletion and deteriorating fisheries are a common consequence of eutrophication. Mechanical aeration can be used to increase the volume of oxygenated water and to help prevent winter fish kills. It can also help sustain high quality fisheries in summer and winter.

Drawdown In an impoundment, weeds can sometimes be controlled by lowering the water level and exposing them to drying or freezing. Exposing the littoral zone may also facilitate dredging or result in shrinkage of soft muck, this deepening the lake without expensive dredging. It may also cause slumping of the shoreline.

Dilution Lake flushing may aid lake restoration. By adding low-nutrient water, the nutrient content in lakes may be reduced below levels necessary for nuisance growths. This technique requires large volumes of flush water, and does not eliminate phosphorus from the sediments.

Blanketing In limited areas around docks, plastic sheeting and sand blankets have been used to seal off lake bottom sediments, reducing the transfer of nutrients to the water and hampering aquatic plants from rooting.



Who Can Do It?

Private Actions by Lake Property Owners

The following checklist is adapted from a phamplet developed by a lake association to protect its members' recreational experiences as lake property owners:

Siting the House

- ☑ Don't let your house intrude upon the lake. Keep a belt of natural vegetation between house and lake.
- ☑ If in doubt about cutting a tree or clearing understory, wait. Make sure your builder and excavator know which trees you want to save. Fence off an area to protect the roots from excavating, filling and heavy equipment–the roots often extend beyond the branches.
- ☑ Avoid putting a road or wide path down to the lake. Curve any path you do construct.
- ☑ Make the exterior finish of your house harmonious with the lake and woods. Avoid a stain or paint that is too light. Use dark shingles.

Information on species recommended for vegatation is available in Michigan State Cooperative Extension Bulletin E1117 or from your local University Extension office.

Any filling, dredging or alteration of the shoreline requires a permit from the Wisconsin Department of Natural Resources.

Altering the Waterfront

- ☑ Be wary of dumping sand on the waterfront. Such activities often blot out natural features of your shoreline, become an eyesore, and harm fish, aquatic insects and frogs.
- ☑ Make waterfront equipment such as docks and boat houses as unobtrusive as possible. Avoid permanent structures that require shoreline alterations, tree clearing and filling.
- ☑ Remember that a steadily burning or bright light on your dock destroys the beauty of the night for others.

Yard Care

- ☑ Consider whether a lawn is needed in a lake setting-mowing takes time and is noisy.
- ☑ Minimize the use of pesticides and fertilizers.
- ☑ Don't burn leaves on a slope from which the ash (fertilizer) can wash into the lake.
- ☑ If natural vegetation has been damaged, plant a vegetative "buffer."

Waste Disposal

- ☑ Be sure that the required percolation tests have been made and are satisfactory. (A certified soil tester must conduct the tests.) Place the septic tank drain field as far from the lake as possible. (County codes require at least 50 feet between the lake and the end of the drain field.)
- ☑ Understand the appropriate regulations and take a personal interest. Don't leave the arrangements entirely to your contractors.
- ☑ If a conventional septic system is unsuited for your lot, you may have to install a holding tank or an approved alternative such as a mound system. If these alternatives are too expensive, don't buy the lot.
- ☑ Use nonphosphate detergents.
- ☑ Conserve water to avoid stressing your septic system:
  - Avoid running laundry for a few items
  - Space out laundry loads
  - Use water-saving showers and toilets.
- ☑ Avoid garbage disposals.
- ☑ Keep solvents, plastics and paper diapers out of the system.
- ☑ Have your septic tank pumped at least every three years.

Group Actions

Lake property owners are responsible for many lake problems. These riparian property owners can prevent or solve some problems by individual actions. However, most problems require an organized approach. At the local level, the following types of organizations are involved: voluntary lake associations, community service clubs, mandatory lake associations, town sanitary districts and lake management districts.

Voluntary Lake Associations Interested property owners have formed several hundred lake associations in Wisconsin. Membership is voluntary. Dues range from $2-$25 per family per year.

A voluntary association is appropriate if the solutions to problems do not require large amounts of money or statutory authority. A voluntary association can achieve many worthwhile objectives. It can foster community spirit and lobby public agencies to take direct management actions.

A voluntary lake property owners association can be organized as a nonstock, nonprofit corporation under Wisconsin Statutes.

Community Service Clubs Chambers of Commerce, Lions Clubs, the Jaycees, and other groups often recognize the value of a lake to their communities. They might organize a volunteer effort to build a swimming beach or clean up debris. They might urge the city council or Wisconsin Department of Natural Resources (DNR) to take certain actions. They may spearhead a campaign to form a lake management district.

Mandatory Lake Associations A mandatory association is established by a lake developer through recorded deed covenants. The covenants require each lot buyer to be a member

of the association and pay dues. Since mandatory associations often own and operate common facilities such as private beaches, club houses and golf courses. the dues are substantially higher than those of voluntary associations.

Since most lakes in Wisconsin were developed without the necessary covenants, this type of organization is limited to a few, mostly recent, lake developments.

Town Sanitary District The purpose of a sanitary district is to allow property owners in heavily developed, but unincorporated, areas to form a special purpose unit of government to provide some or all of the following:

- public sewer
- public water
- garbage removal
- storm water drainage
- treatment of aquatic nuisances
- septic tank inspection.

In the past. voluntary lake associations often helped organize sanitary districts to take advantage of the legal and financial strengths of sanitary districts. The legal basis for town sanitary districts is found in Sections 60.77-60.78 of the Wisconsin St. They have the ability to raise funds through taxation.

In recent years, town sanitary districts have not been formed to manage lakes because a more appropriate mechanism is available-the lake management district. Some sanitary districts have merged with or been converted to lake management districts.

LAKE MANAGEMENT NEEDS AND ORGANIZATION ABILITY

Percent[1]	Lake Management Activities	Organizational Structures[2]					
		Voluntary Association	Lake District	Sanitary District	Town Gov.	County Gov.	DNR
81	Stocking fish	*	*				**
71	Enforcing building codes				*	**	
66	Contacting officials about property tax	**	*				
66	Inspecting private septic tanks		*	**		**	*
64	Monitoring sources of pollution	*	**				*
63	Pumping and servicing septic tanks		*	**		*	
57	Patrolling for vandalism				*	**	
53	Stabilizing water levels	*	**		*	*	
47	Regulating snowmobiles				*	*	*
42	Planning development		*		*	**	
40	Patrolling for water safety	*	*		*	*	*
37	Chemically treating weeds or algae	*	**	*			
36	Cutting lake weeds	*	**				
35	Collecting garbage and trash		*	**			
34	Stopping shoreline erosion		**			**	
30	Sponsoring beautification projects	**	*				
19	Dredging		**				
15	Providing public water		*	**			
9	Providing lifeguard service	*	*		*	*	

[1] Percent who feel this activity is needed on their lake, based on a survey of northern and central Wisconsin lake property owners. The activity may or may not be presently performed on the lake. Some concerns deal directly with water quality; others relate to the lakeshore community more generally.

[2] The group that is suggested to be most likely to deal with a concern or carry out the activity is shown with a double asterisk (**). Other groups that may be able to accomplish the task under certain conditions are shown with a single asterisk (*).

Lake Management Districts

In 1974, following six years of demonstration work, the Wisconsin Legislature enacted the Wisconsin Lake Management Law. Chapter 33, Wisconsin Statutes, authorizes a joint state-local partnership that permits local lake property owners to organize a lake district to protect or improve a lake. Such local efforts are supported by technical and financial assistance from the DNR with educational assistance from UW-Extension.

Between 1974 and 1982, more than 130 Wisconsin communities organized lake districts.

Why Are Lake Districts Needed?

Local property owners form lake districts for two major reasons:

(1) They need a strong local organization with interest in the lake, with legal authority to assume management responsibility for the lake, and with power to assess costs according to benefits received. People working through the earlier types of lake organizations have done some worthwhile things. But in many cases they have been frustrated in their efforts because the organizational structure available at the local level was not well suited for lake management. Voluntary associations do not have sufficient legal and fiscal authority to undertake comprehensive lake management. Mandatory associations can be formed only before development occurs and therefore this alternative is not available to most lake communities. Sanitary districts have been bent to serve lake management needs but they lack the scope necessary to do the job.

(2) They need technical and financial assistance. Solving lake problems is complicated and requires more than dedicated efforts and good will. Local people want and need technical assistance from lake managers.

Both property owners and general public users benefit from the lake, and both groups should be asked to pay part of the costs of protecting and managing it.

A lake may not need a lake district if the people around the lake are happy with their present situation and are confident it will not change. In many situations a voluntary association may be adequate. The lake may be sufficiently protected by the characteristics of the watershed and present patterns of land use.

But lake property owners may want to organize a district to prevent problems from arising rather than face expensive corrective action later. For example, a district may want to buy nearby wetlands to protect the lake. If a district protects a wetland, wetland functions will continue and the density of shoreland development will be limited by preserving a part of the shoreline in its natural state.

Formation

Public inland lake protection and rehabilitation districts are initiated at the local level, often by a voluntary lake property owners association or service club. The initiators must decide on the appropriate boundaries. While this decision is a purely local one, the following guidelines may be helpful:

1) Include all riparian property since all property on the lake will be benefited by a better lake.

2) Include property which isn't on the lake but is lake-oriented (campground, mobile home park, subdivision).

3) Include as much of the watershed as is logistically and politically feasible.

Once proposed boundaries have been drawn, the organizers must obtain the signatures of at least 51 percent of the persons owning real estate or the owners of at least 51 percent of the land within the boundaries. The petition is presented to the town board or county board which holds a hearing after notifying all landowners in the proposed district. Following the hearing, the board decides whether to create the district.

If a lake is located entirely within a village or city. the governing body of that municipality can create a lake district without a petition. The district in this case is created by a resolution.

Powers As a unit of government, a lake district can make contracts, hold real estate and disburse money. Its lake management powers include but are not limited to the following:

1) studying causes of lake problems,
2) treating aquatic weeds,
3) treating algae,
4) treating swimmer's itch,
5) aerating the lake,
6) diverting, removing or inactivating nutrients,
7) controlling erosion,
8) dredging,
9) treating bottom sediments,
10) constructing and operating water level control structures.

Some of these activities require permits from the Department of Natural Resources, the state partner in lake management.

For details on formation or operation of a lake district, see the latest edition of "A Guide to Wisconsin Lake Management Law," available from DNR and UW-Extension offices.

The district does not have regulatory powers on either the land or the water but may ask counties, towns, cities and villages to enact needed ordinances. The district can take any other measures necessary to improve and protect public inland lakes.

A lake district may seek sanitary powers from the town board and, if approved, may provide one or more of the services of town sanitary districts, such as public sewer, public water, garbage removal. regulation of septic tanks and storm water drainage.

Operation The major decisions of a lake district are made by residents and property owners voting at the annual meeting. The annual budget and all individual projects costing the district over $5,000 must face a vote. By approving a budget, the annual meeting also selects a mill levy tax (not to exceed 2.5 mills), a special charge, or a special assessment to provide budget dollars.

Between annual meetings, the district is governed by a board of commissioners which usually consits of:

- three property owners or residents within the districts, elected at the annual meeting,
- a county board member who is also a member of the county land conservation committee,
- a member of the governing body of the town, village or city having the highest valuation within the district.

Where the entire lake is within one municipality, the commission may consist of the town board, village board or city council.

The lake district operates under a set of bylaws which are adopted by the district to establish procedures for the annual meeting and duties of commissioners.

A Typical Sequence of Action in a Lakeshore Community

Step 1. Organize a Formal Group

- Stimulate discussion by concerned property owners.
- Hold community meetings to discuss creation of a formal group. You could invite your county Extension agent, DNR lake management coordinator, county conservationist, or other professionals.
- Appoint an ad hoc committee to recommend the type of organization.
- Organize an educational meeting to explain procedures for formation of a voluntary lake association or lake district. A lake management professional or experienced citizen from another lakeshore community should be invited.
- Create a formal association or district.

Step 2. Clarify Lake Use Goals

- Use surveys, discussions at annual meetings, or both to determine the preferences (scenic beauty, fishing, swimming, boating, skiing, waterfowl habitat) of residents and property owners.

- Determine the physical ability of the lake to accommodate various uses by gathering existing information on the lake and asking a professional (DNR, UW, or private consultant) to help interpret the information. Your DNR lake management coordinator can give you advice on the extent of additional studies that may be needed.
- Select goals for future lake use that are consistent with the lake's capability and the community's preferences.

Step 3. Adopt a Plan of Action

- Chart alternative management techniques with professional assistance from the DNR and others. For each alternative, list:
  –strengths and weaknesses
  –cost
  –data needs.
- Select studies and management activities.
- Solicit comments on proposed activities.
- Set realistic objectives, such as:
  –tons of weeds harvested
  –acres of easements purchased for watershed protection
  –passage of zoning ordinance
  –memorandum of agreement with county Land Conservation Committee
  –water level maintained within 3 inches of ordinary high water level
  –miles of streambank fenced
  –dissolved oxygen maintained at 5 parts per million
  –assistant county sanitarian hired to improve enforcement of septic system regulations.
- Set realistic timetable for each phase.
- Indicate the committee or officer responsible for implementation of each part of the plan.
- Present the plan proposed by the board to the organization's members with opportunity for review and discussion.
- Ask for a formal vote on the plan and a corresponding budget.

Step 4. Implement Projects to Achieve Goals

- Present your plan to local and state officials and organizations whose assistance you will need.
- File applications for permits and financial assistance as needed.
- Purchase materials and services from private contractors.
- Arrange for local financing (tax, special assessment, dues, fund raisers, gifts).
- Make recommendations to local municipal boards and county board.
- Audit project expenses.

Step 5. Evaluate the Extent to which Objectives were Attained

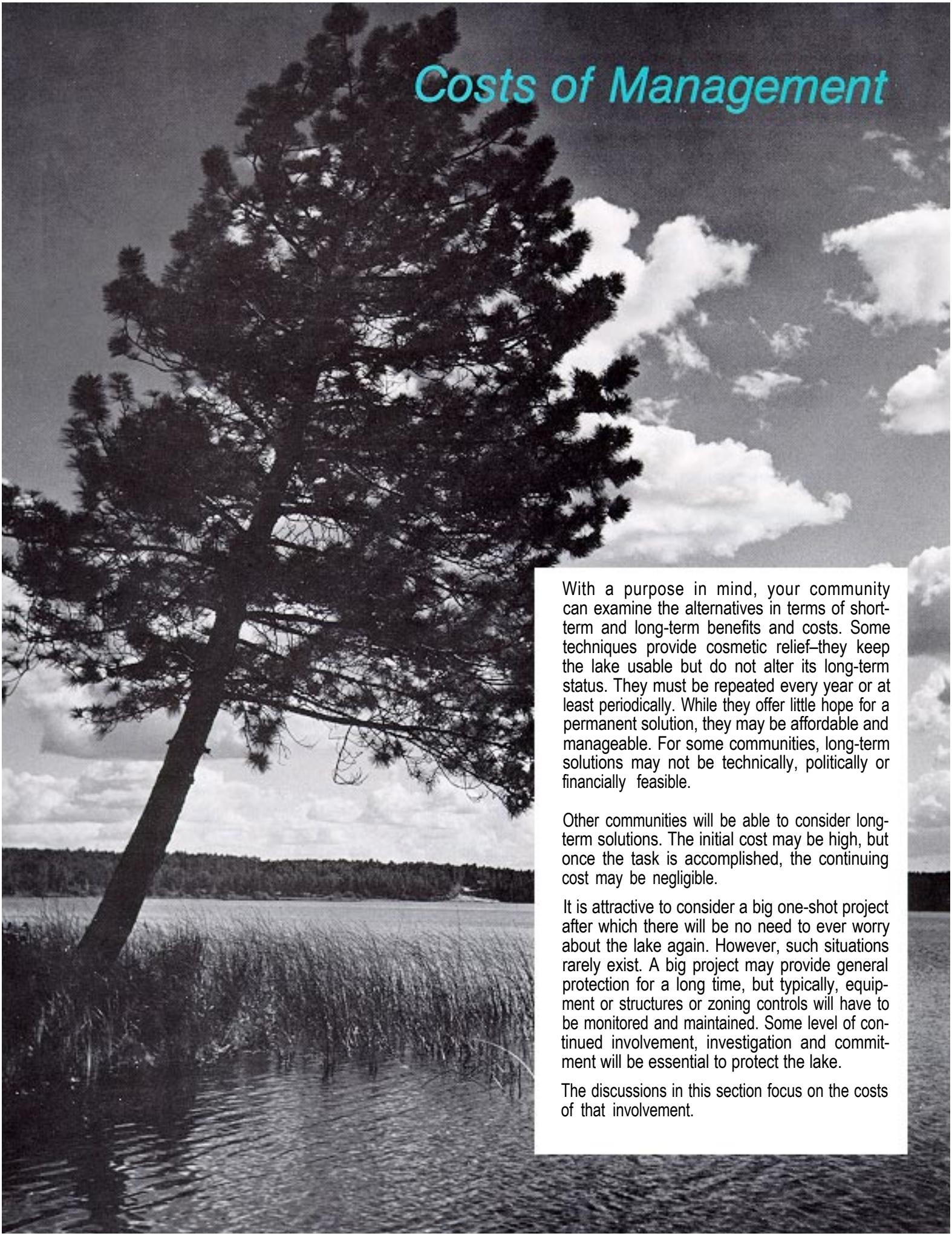
- Present progress reports at your annual meeting each year.
- Update your plan at least every 5 years to address new problems and changing conditions.

Step 6 Monitor Water Quality for Long-Term Changes

- Select tests
  –secchi disc to measure water clarity for presence of algae
  –lake level to document seasonal changes in water level
  –water chemistry to determine the amount of plant nutrients and other chemicals in the water
  –dissolved oxygen to monitor susceptibility of fish to winterkill.
- Make commitment to continue for at least 10 years.
- Maintain records.

Sample outline for a written lake management plan:

I. Lake Management Goals
II. Lake Description
  A. Basic physical data
  B. Uses
  C. Problems
  D. Previous or current management activities
III. Management Alternatives Chosen (Reasons why other alternatives were considered less likely to achieve the goals)
IV. Implementation Strategy
  A. Specific management activities and results expected from each
  B. Project financing
  C. Target timetable
  D. Organization of management team and delegation of specific responsibilities
V. Evaluation of Management Activities
VI. Long-term Monitoring



Costs of Management

With a purpose in mind, your community can examine the alternatives in terms of short-term and long-term benefits and costs. Some techniques provide cosmetic relief–they keep the lake usable but do not alter its long-term status. They must be repeated every year or at least periodically. While they offer little hope for a permanent solution, they may be affordable and manageable. For some communities, long-term solutions may not be technically, politically or financially feasible.

Other communities will be able to consider long-term solutions. The initial cost may be high, but once the task is accomplished, the continuing cost may be negligible.

It is attractive to consider a big one-shot project after which there will be no need to ever worry about the lake again. However, such situations rarely exist. A big project may provide general protection for a long time, but typically, equipment or structures or zoning controls will have to be monitored and maintained. Some level of continued involvement, investigation and commitment will be essential to protect the lake.

The discussions in this section focus on the costs of that involvement.

Local Financing Voluntary associations and some lake districts raise funds by holding raffles, fisherees, bake sales, auctions, street dances and by asking for contributions.

In addition to these traditional sources, lake districts have taxing power. Most districts use these powers at least periodically. The various types of taxing authority are:

LOCAL REVENUE SOURCES FOR LAKE DISTRICTS

1. Informal, voluntary contributions
   example: donation of time to take water samples
2. General property tax
   example: annual maintenance costs of dam
3. Special charges
   example: weed cutting service
4. Special assessment
   example: major dredging project
5. Temporary borrowing
   example: emergency repair of equipment

State and Federal Aid Living on or near a lake, you derive special benefits from the lake and from efforts to manage the lake. You derive more benefits than an average citizen. Therefore, you should bear special responsibility to maintain the lake. The taxing powers listed previously are designed to collect revenue from all those property owners who derive special benefit.

However, other citizens use the public access and also benefit from a clean lake. These people should help pay for lake management. Because of the public benefit to people who live outside the district, the state and federal government have provided cost sharing for most major lake projects.

Before 1983, most lake districts used state cost sharing for the study phase.

Major improvement projects have often been cost shared by more than one DNR program (such as the inland lakes and Wisconsin Fund non-point source pollution program) and more than one federal program (such as Clean Lakes in the U.S. Environmental Protection Agency and Agricultural Stabilization and Conservation Service in the U.S. Department of Agriculture). Major state and federal grants were available for early implementation projects. However, the local lake district had an obligation to contribute at least part of the funds or to meet its obligation by contributing labor or material to the task.

The availability of funds and rates of costs sharing have changed in the past and may change in the future. The federal government has not been consistent in its support of clean lakes. State cost-sharing rates may be lower for certain projects. For instance, manure storage facilities help the farmer with his operation; a lower cost-share rate is justified when building such facilities on private land.

State funds must be reappropriated by each legislature. During difficult economic times, no funds may be available.

Administrative Costs Lake management usually involves permits and grants. To obtain both, someone must understand administrative codes of state and federal agencies. After a grant is awarded, records must be kept and reports filed.

Assistance is usually available in the courthouse from UW-Extension, the land and soil conservation office, the county planning and zoning department, or DNR. However, some local citizen must be willing to take the time to seek help, attend workshops and keep the books in order.

Many projects will also require personnel management skills. Someone must supervise the weed-harvesting crew or monitor the progress of the dredge. In planning a large project, it is advisable to hire a project manager who takes policy direction from the commission, but has full authority to direct the work and handle basic administrative responsibilities.

Social and Environmental Costs As indicated, costs will vary depending on severity of the problem, size of the lake and the techniques used.

Some lake projects are bitterly debated. Even after a decision is made, bad feelings may linger in the community. Some people may feel the decision-making process was not conducted properly. In extreme cases, lawsuits may result.

These costs can be minimized by making sure all members of the community have an opportunity to learn and to participate in project decisions. Commissioners can set the tone of meetings by making it clear that they will follow the statutes and by-laws and that they are sincerely interested in everyone's input.

Some proposals for lake management may help the lake in the short run, but damage another resource, such as disposing of dredge spoils in wetlands. Attempts to evade state and federal regulations on these matters are likely to delay the lake project and divide the community.

Maintaining the Organization Every organization must try to reach its goals and maintain a viable group. No magical formula exists for making an organization run smoothly and efficiently. Two main components, however, are leadership and member participation.

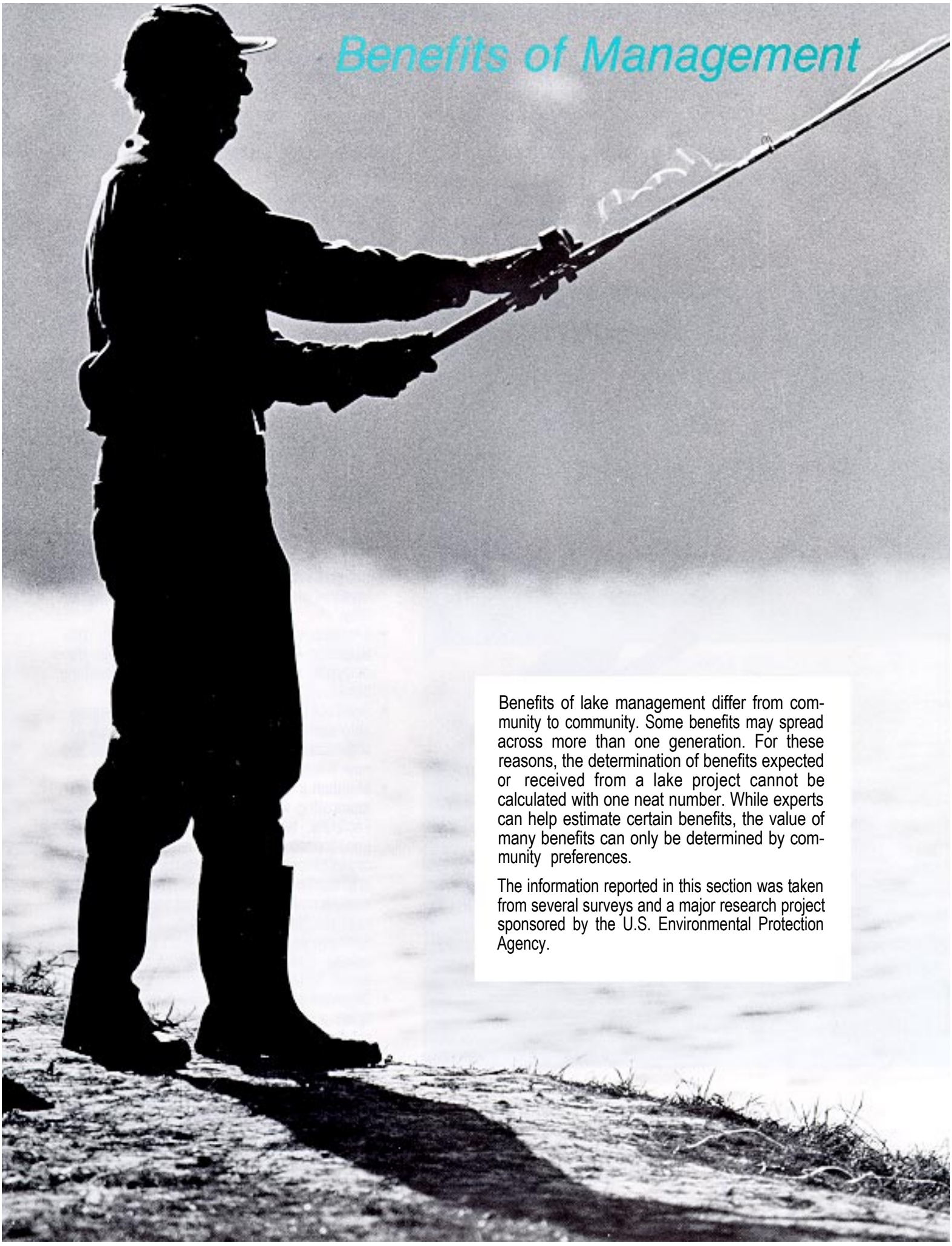
Leadership needs may differ for an organization at various times. When an organization is young and struggling for identity and direction, it needs an energetic leader who can inspire members and work relentlessly to accomplish group goals. Later, leadership duties require a diplomat who maintains the smooth internal operation of the organization. Both types of leaders are always needed, but the role of the diplomatic leader becomes more important as the organization matures.

Member participation is the foundation of any organization. Participation is often difficult to obtain and keep. As the size of the group increases, the individual is less able to see how his or her participation makes a difference in the outcome. If an individual benefits from group activities without becoming a member, then he or she has little incentive to participate. In many types of lake protection activities, all property owners benefit whether they incur costs of participation or not. That is why voluntary organizations seem to work best for small groups who engage in social and political activities but do not undertake major lake management activities.

In addition to these general considerations the following suggestions may help group leaders deal with the participation problem:

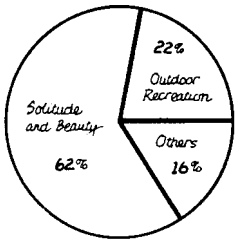
- Decide on the degree and kind of member participation that is necessary to meet organization goals. Don't ask people to become actively involved unless there is a specific role they can play.
- Emphasize the positive effects of participating–show the member how his participation will make a difference in reaching common goals.
- Point out certain social advantages in membership such as the sense of belonging. The lake organization must show what it has to offer and how it will help a member.
- Maintain a sense of ongoing activity by communicating with members on a regular basis. Facilitate two-way communication through questionnaires and newsletters. Some lake organizations have newsletters that report organization activities. Newsletters may also publish historical sketches of the area or short excerpts from publications on lakes. A questionnaire can be sent out with the newsletter asking members their views on important issues facing the organization.
- Organize a lake tour for members, elected officials and media people to view problems and solutions firsthand. Have a knowledgeable person at each stop to describe the situation and answer questions.
- When the group achieves success or an individual makes a major contribution, be sure to show appreciation with press coverage, an award or other means of recognition.

Benefits of Management



Benefits of lake management differ from community to community. Some benefits may spread across more than one generation. For these reasons, the determination of benefits expected or received from a lake project cannot be calculated with one neat number. While experts can help estimate certain benefits, the value of many benefits can only be determined by community preferences.

The information reported in this section was taken from several surveys and a major research project sponsored by the U.S. Environmental Protection Agency.



Natural Beauty and the Quality of Life

The visual component (esthetics) is a major part of the quality of life for lake property owners and the whole community. Lakes are used more frequently and by more people for their natural beauty than for any other purpose.

Lake property owners feel "solitude and beauty" is the most important pleasure derived from owning lake property. Outdoor recreation is most important to about one-fifth. Social reasons such as companionship and prestige account for most of the other motivations.

Lake property owners themselves can be the major threat to the natural beauty of the lake when they clear shoreline to build homes, docks, and boathouses. However, many lake management projects have the potential of enhancing or diminishing the visual component. The absence of unsightly structures, mud flats, algae or floating debris improves the view for everyone.

Two out of tree Wisconsinites use lakes each year. About five percent own shoreline property. An additional 60 percent enjoy lakes via public access points, parks and roadways.

Fishing, Swimming, Boating Fishing is the most popular water sport; 93 percent of lake property owners and 44 percent of the general public participate annually. Improved fishing is most frequently the primary objective of lake management efforts. Swimming and boating are nearly as popular and also benefit from lake management. However, these sports are not completely compatible. For instance, swimmers and boaters would like a "weed-free" lake, while fishermen know that a modest amount of vegetation is necessary for fish.

Water Quality and Property Values

While natural beauty, quality of life and similar impacts are difficult to evaluate, their value can be estimated through their impact on property values.

There are economic techniques to calculate how important a lake is to property values and the local tax base. The techniques are based on the assumption that people are willing to pay more for land if it is close to the lake–at least as long as the lake is perceived as an asset, and that this value will be capitalized in the property value.

Such an analysis was conducted for the first project completed under the Wisconsin Lake Management Program. The City of Waupaca organized a lake district in 1974. In 1976, it received a grant of about $200,000 from the federal government and about $100,000 from the state. By placing a mill levy of 0.9 mills on the property in the district for two years, the $80,000 local share was collected. The project consisted of diverting storm sewers from Mirror and Shadow Lakes; adding alum to inactivate the phosphorus already in the lakes; and aerating Mirror Lake, which does not "turn over" with the seasons because it is deep and sheltered from the wind.

Total project costs were approximately $400,000. The impact of water quality changes on property values expected over 34 years was calculated.

This value was determined by estimating the property values if the lakes had continued to deteriorate and comparing them to the estimated property values with the restoration project. Because a dollar of benefit in the year 2010 is worth a lot less than a dollar in 1977 when the project was completed, the benefits were discounted back to 1977. Obviously, the choice of the proper discount rate is critical in estimating benefits in this fashion. If an interest rate of seven percent is applied, the benefits total over $1,000,000. If an interest rate of 15 percent is applied, the present value of benefits is worth less, about $800,000.

Regardless of choice of discount rate, the analysis would suggest the $400,000 investment was justified. For example, the benefit/cost ratio with seven percent interest is:

$$\frac{\$1,000,000}{\$\ 400,000} = 2.5$$

And the benefit/cost ratio with 15 percent interest is:

$$\frac{\$\ 800,000}{\$\ 400,000} = 2$$

In other words, the benefits, as measured by the estimated change in property values, are two or two and one-half times the amount of money invested.

Community Image Many communities were built around a lake or millpond. The visual quality of these communities is highly dependent on the sparkle of the water body and the lakeshore. The lake can be the center jewel of the landscape or it can be an open sore. How your community manages its water resource will leave a big impression on visitors.

The willingness of your community to manage the lake will affect more than visitors. It also has a big impact on the attitude of the citizens of your community. If your community doesn't care about its public resources, why should citizens worry about their neighborhoods and homes. Just as

the sparkle of one part of the community reflects the shine of other parts, the tarnishing of the lake resource diminishes other parts of the community as well.

Community pride or indifference is infectious. A healthy lake contributes to the image of a community and to its self-image. A neglected lake has the opposite effect.

Knowledge, Experience and Confidence The benefits discussed previously are related to water quality. If the project enhances the quality of the lake, benefits will follow.

A second set of benefits is not related to the physical status of the lake. These benefits result from the process of undertaking a community project.

Citizens who participate in a lake project learn:
- the ecology of their lake
- the management potential of their lake
- about several government agencies
- about coping with bureaucracy
- leadership and organizational skills.

The community benefits when its citizens have such knowledge and experience. They will have more confidence in trying to solve other community problems. They will know people in government agencies and some of the ways to cut through red tape.

The community also benefits from the new leaders that surface from the project. The new leaders may seek public office or provide initiative in other ways.

These benefits were particularly evident at White Clay Lake in Shawano County. Farmers in the watershed organized a lake district through their town board. With help from UW-Extension, the Soil Conservation Service, the Agricultural Stabilization and Conservation Service and other agencies, the district applied for funds to reduce agricultural run-off from barnyards. The cost of these improvements was approximately $200,000. Some additional work was carried out in the watershed to reduce erosion.

White Clay Lake District residents were active in creating and operating the district. Most residents attended lake district meetings. They understood the cost-share rates they were receiving from the state and federal government. When tested on their understanding of lake management, they scored much higher than a random sample of Wisconsin adults.

A healthy lake enhances the community

A neglected lake has the opposite effect

Forming a lake district in a rural area was a major community event. It marked the first time that area residents had worked as a group and identified themselves as a group. The lake district chairman was later elected to the town board and given an award by the Wisconsin Association of Soil and Water Conservation Districts. Numerous groups and the media toured the project. The community was proud.

Participation in a lake district is practice in self-governance. Lake districts are local people learning, organizing, deciding and carrying out a scheme to manage their lakes. Practice in democracy, while often frustrating, is a significant benefit.

For More Information and Assistance

People and Pamphlets

Personal consultation, "A Guide to Wisconsin's Lake Management Law," "Lake Tides" (newsletter), "Instructions for Self Help Monitoring," "Lakeshore Property Owners' Information File Folders," and other materials can be obtained from:

County UW-Extension offices

District Headquarters
Wisconsin Department of Natural Resources

Richard Wedepohl
Bureau of Water Resources Management
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, Wisconsin 53707

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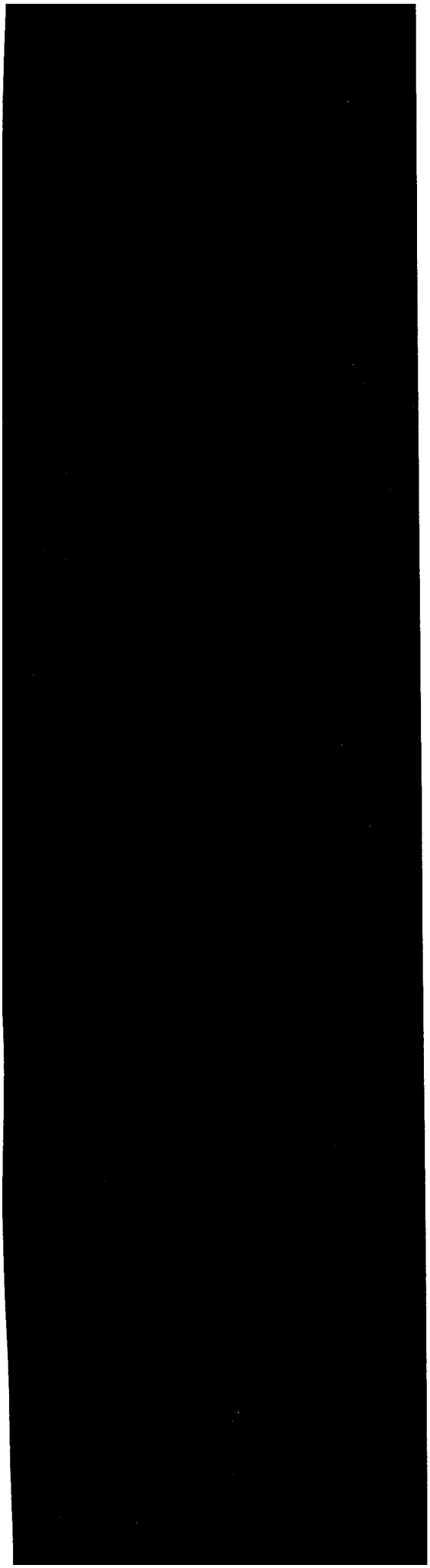
Research in this report was conducted under Grant #R804802-01-2 from the U.S. Environmental Protection Agency and earlier grants from the Upper Great Lakes Regional Commission. Conclusions are those of the authors and do not necessarily represent the position of the sponsoring agencies.



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The authors are grateful to the following reviewers: B. Baker, N. Christiansen, R. Dunst, G. Gibson, D. Knauer, S. Smith, M. Vollbrecht, R. Wedepohl, and O. Williams.

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G3216 The Lake in Our Community **RP-02-94-4M-300-S**

This publicafion was produced in cooperation with the Wisconsin Department of Natural Resources,